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ABSTRACT

Presented is one of five Wildlife and Environmental Education Teaching units that deal with resource management in a way that includes man as user and manager of natural resources. Included are activities (with their suggested grade levels) that deal with population dynamics. Fifteen supportive activities are described. A list of recommended films and references is appended. Included within the unit is an evaluation sheet for teachers of the unit. (CS)

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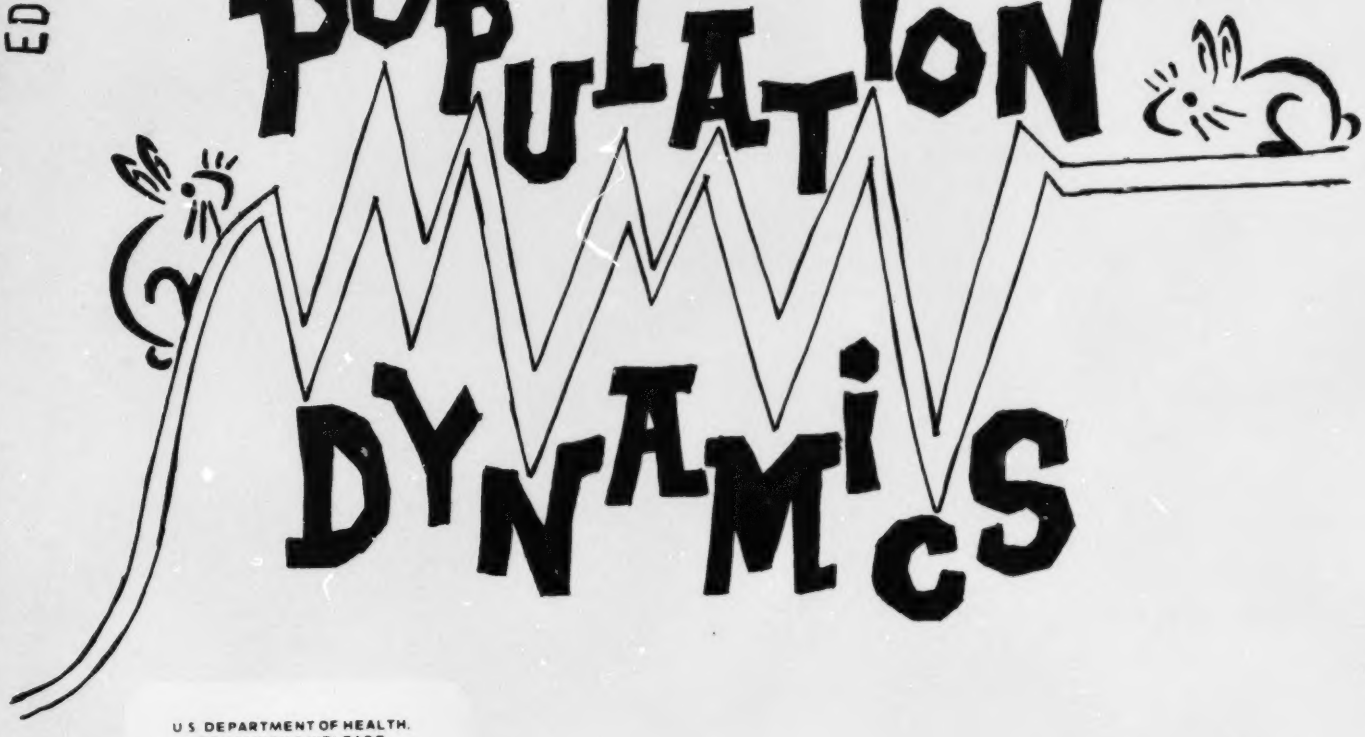
POPULATION DYNAMICS



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A Curriculum Guide for Elementary and Secondary Teachers

Developed by

Department of
Environmental Protection
Division of Fish, Game,
and Wildlife
Wildlife Education Unit

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DEAR EDUCATOR:

This Wildlife and Environmental Education Teaching Unit is one of a five part series that has been developed under the auspices of U.S. Office of Environmental Education. The need for this educational package was recognized after the New Jersey Division of Fish, Game, and Wildlife conducted several Teachers Workshops regarding natural resource management. After an extensive search it became apparent that very little curriculum material was available that dealt with resource management in a way that included man as user and manager of these resources. Within this shortcoming was an even greater assumption that certain student entrance level skills and knowledge were firmly established when, in fact, they were almost non-existent. Hopefully, this material will help overcome these problems.

The topics covered are somewhat controversial in focus but rather straightforward in content. A broad format has been chosen so that it can be easily adapted to meet the needs of individual school systems. Although most of the topic areas have a science orientation a special effort has been made to include Humanities, Social Sciences, Arts and Math activities.

Originally, the project intended to develop separate activities for both the elementary (targeted for 5th grade) and secondary (targeted for 10th grade) levels. However, during the course of the work, it became apparent that many of the activities overlapped these grade levels and could be easily adapted to meet the needs of upper and lower grade levels. To avoid duplication we elected to combine the curriculum into one booklet.

We have included suggested grade levels with each activity, however, these are only guidelines. The activities were written with the teacher in mind and not as something to be handed directly to the students.

All of the activities have been tried and tested within selected school systems.

The accompanying evaluation sheet will aid us in making further improvements in the project. Your evaluation will be greatly appreciated. Thank You.

Robert L. Byrne
Project Director

POPULATION DYNAMICS

Common Misunderstanding:
People are not aware of the dynamic nature of wildlife populations or the environmental forces acting upon those populations and causing the changes to occur.

Resultant Problem:
People tend to view "natural" ecosystems as static, unchanging entities. Individual animals within a population are also viewed as having a longer life span than they actually do. Both of these ideas promote a "hands-off" attitude towards management of the animal *population* or the ecosystem. Alterations of the ecosystem or harvesting surplus animals within a population are viewed to do irreparable damage when, in many situations, the opposite is true.

Learning Concept Needed:
Wildlife is a renewable natural resource that is dynamic in its response to environmental forces. Any given wildlife population is a reflection of the environmental conditions present at *that time.* It is not static, but constantly changing in response to the constantly changing conditions surrounding it.

Concepts (Umbrella Ideas):

1. Wildlife is a renewable natural resource.
2. A population is defined as the number of a particular species occupying a given area at a given time.
3. The density of a population is the number of organisms divided by the area occupied (D = N/A).
4. Populations change, often dramatically, over a period of time.
5. The birth rate (natality), death rate (mortality), movement in an area (immigration) and movements out of an area (emigration) cause a population to be in a constant state of change.
6. A given area can annually support only a limited population (carrying capacity).
7. The environmental limiting factors reduce a population so that it is equal to the amount that the habitat can support at any given time.
8. The biotic potential (potential birth rate) of each population exceeds the ability of the environment to support the off-spring.
9. If any "balance of nature" exists, it is a *Dynamic Balance.*
10. That part (percentage) of a population that is lost through the various limiting factors can be utilized by man without affecting the overall population.

BEHAVIORAL OBJECTIVES:

The student will be able to:

1. define; carrying capacity, habitat, limiting factors, annual turnover, succession, renewable natural resource, nonrenewable natural resource, species composition, population, population density, dynamic balance, birth rate (natality), death rate (mortality), biotic potential, immigration, and emigration. (See Appendix for vocabulary).
2. list and describe the factors affecting population changes.
3. list and describe the effects of limiting factors on a population.
4. describe and graphically represent the three dispersion patterns in which populations may occur.
5. list renewable and non-renewable natural resources.
6. diagrammatically describe the concept of dynamic balance.
7. diagram a typical "annual turnover" curve.

INTRODUCTION

The "balance of Nature" is a concept that is a corner stone in everybody's foundation concerning wildlife populations. This concept, however, is generally accepted on face value alone. Very little effort is expended in trying to determine the true nature of the supposed "balance."

Wildlife populations are a reflection of the environmental conditions that are present at any given time. These conditions are constantly changing and, therefore, the wildlife populations that respond to these changes are constantly changing. If any balance exists it is a dynamic balance. There is no point on which a population rests, but rather, it rests upon numerous environmental conditions.

The dynamic balance concept is quite different from the standard static balance concept in several ways. It accurately describes the reality of wildlife populations, and that these populations are a renewable natural resource. This innate renewability, in turn, reinforces the concept that ecosystems are productive entities and that a portion of their productivity is utilized by other organisms.

The standard, static, balance concept does not reinforce the renewability aspect of the wildlife resource. It passively promotes a hands-off, preservationist, attitude. This attitude is contrary to both the wise-use definition of conservation and the reality of energy transfers within ecosystems (see *Energy in the Ecosystem* curriculum guide).

Resource utilization is essential for man to exist. The *whys* and *wherefores* of that utilization is dependent upon societal needs and the resource itself. In the case of a renewable resource, like wildlife, it is important that the dynamic nature of that resource is firmly understood before societal decisions regarding its uses are made.

CLASS DISCUSSION

Through guided questioning establish the definitions of the various terms used in describing populations.

The parameters of a *population* are; 1) the *kind* of organism (species) 2) the *number* of organisms present 3) the particular *place* occupied and 4) the *time* span involved. Because time is involved in the definition of a population, the population itself, is not static but *dynamic* (changing) in nature. There are annual, seasonal, monthly, weekly, daily and hourly variations in any population. In order for a population to maintain itself it must be able to replace those individuals that die because of various environmental pressures through reproduction. The ability to reproduce is the separation point between renewable and non-renewable natural resources.

For ease of comparison to other similar populations, populations are generally discussed as *population density*. Population densities are calculated by dividing the number of organisms by the size of the area occupied (Density = $\frac{\text{number of organisms}}{\text{size of area}}$).

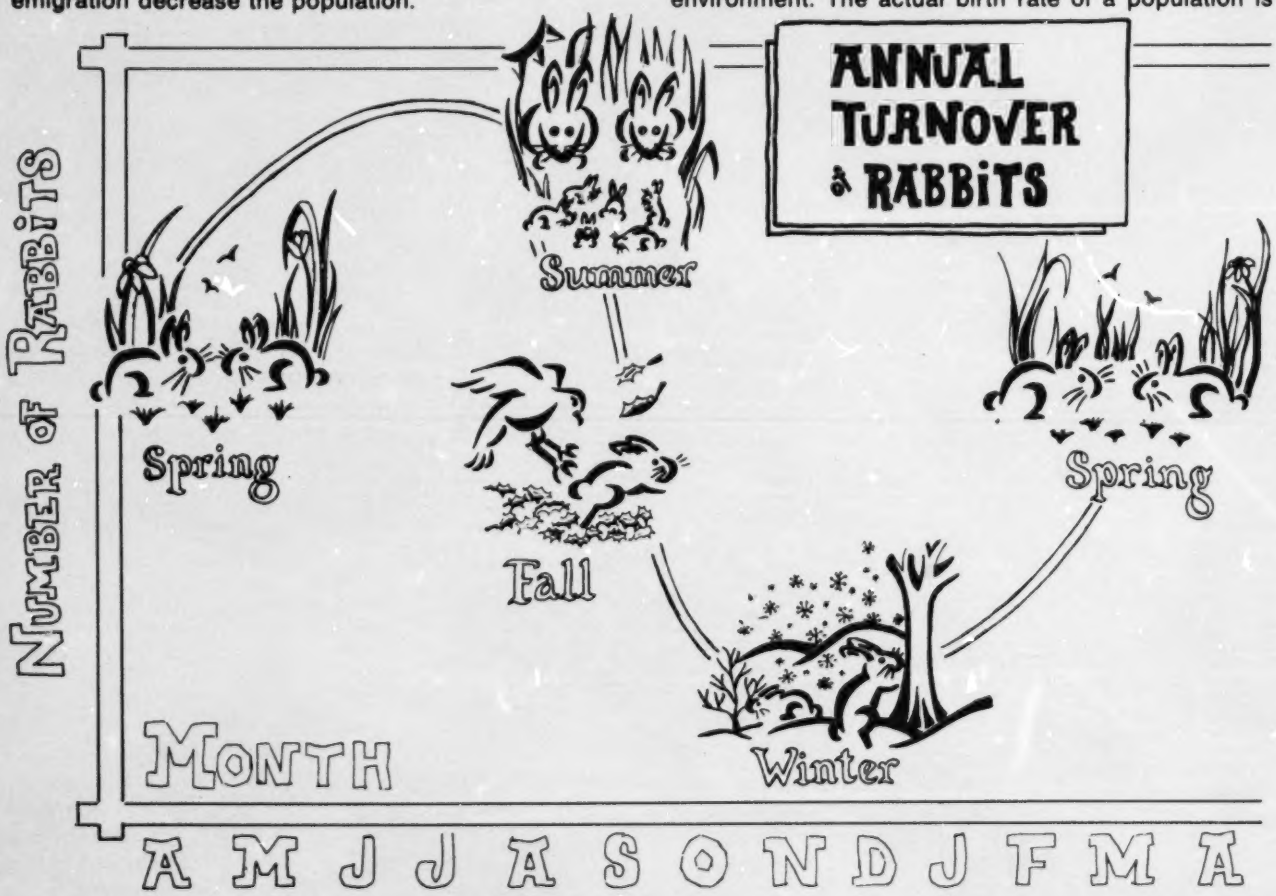
The behavior of a population is best understood by taking many population measurements. The *rate* of a *population change* may be calculated by the following formula:

$$r = \frac{\Delta N}{\Delta T}$$ where r represents the rate of change,

ΔN is the differences in the population and ΔT is the differences between the time that the counts were made.

The rate a population changes is dependent upon four factors; the birth rate *(natality)*, death rate *(mortality)*, movement into the area *(immigration)*, and movement out of the area *(emigration)*. Natality and immigration can increase the population while mortality and emigration decrease the population.

The potential birth rate *(biotic potential)* is a characteristic of the species and usually exceeds the ability of the environment to support the young produced. However, the actual birth rate of a particular population is a reflection of the general health of the population and its environment. The actual birth rate of a population is



less than the potential rate. However, the actual rate usually still exceeds the ability of the habitat to support the young produced.

The mortality rate is the summation of many environmental pressures that act upon a population to reduce number of animals present. These environmental pressures (limiting factors) include; food, cover or shelter, water, extremes in weather, predation, disease, competition (both between two different species and among the same species) for limited resources, and stress (a physiological reaction to environmental pressures). Because of these limiting factors, a habitat is *always* as full as it can be at any given time.

The amount of pressure exerted upon a population by some of these limiting factors is dependent upon the density of that population (density dependent factors). For example, a limited food supply that was "shared" by 100 organisms would exert more "pressure" on that population than if that same food supply only had to support 10 organisms.

Other limiting factors, such as extremes in weather, will exert the same amount of pressure regardless of the population size (density independent factors).

All of these factors are dynamic and cause any population to fluctuate. The fluctuations in animal populations are often extreme and in most cases entirely independent of man's interactions with that population. The annual turnover rate (the rate at which older animals in a population are replaced by younger animals) is usually quite high. In rabbits, for instance, the annual turnover is between 70-80% with or without man's interference.

Individual animals that are "lost" through the actions of the annual turnover rate become part of the ecosystems' productivity. This "excess" productivity is available to be used by other organisms, including man.

The concept that any population is supported by resources and that some of those resources may be limited, is universal in its application. Changes in availability of those resources will result in changes within the population that is being supported. Human population is not exempt from the concept of limiting factors.

Future human developments should certainly be planned with this concept in mind.

SUPPORTIVE ACTIVITIES:

Elementary and Secondary

1. Graphically plot the student "population" in your class over the course of one day. Include those periods of the day when the students are not in school, when they are at lunch, at recess, etc. Discuss the reasons for these population changes and relate these observations with the daily and seasonal changes in wildlife populations. Are there any other reasons that a population changes that were not illustrated?
(References 5, 14, 15, 20, 22, 23)

Elementary and Secondary

2. Play "musical chairs" using chairs as limiting factors in your student population. Add or subtract chairs, which have been labeled with various limiting factors, according to the environmental pressures affecting "real" populations. Discuss how those factors influence other populations.
(References 5, 14, 15, 20, 22, 23)

Elementary and Secondary

3. During the first week in October have your students keep track of the flocks of geese (and the number in each flock) that pass overhead. Plot their observations and discuss the environmental pressures that are causing this population change.
(References 2, 3, 5, 6, 11, 12, 13, 14, 19, 20, 21, 24, 43, 45)

Elementary and Secondary

4. Have a "scavenger hunt" in which your students look for cards that have been labeled with the various needs of specific animals (i.e. food, cover, water, nesting area, weather, competition and stress, etc.) hidden around the classroom or schoolyard. Assign the students an animal to imitate and allow them to hunt for their various needs. Discuss what happens to an animal that only finds "cover" but no "water." Expand and apply these observation to "real" populations.
(References 5, 14, 15, 20, 22, 23)

Elementary and Secondary

5. Once a month have your students count the fire-flies in their yard in the evening. (January, February, March,. . .). Plot this data over the course of the year. Are the fire-flies that occur this June the same ones that were their last June? What do you think happened to them all? What is the average life span of the fire-fly? What determines how many fire-flies are in the area (limiting factors)? Can you "manage" the area (change the limiting factors) to have more fire-flies? Less?

NOTE: You can substitute just about any other "critter" for fire-flies and accomplish the same thing. The purpose of this activity is for the student to recognize the components of habitat, and other "limiting factors."

Habitat = Food + Cover + Water + Living Space
Other limiting factors are; predation, stress, weather extremes, and competition
(References 5, 6, 11, 13, 14, 20, 24, 35, 43).

Secondary

6. Read "Passenger Pigeon, Bird of Yesterday" by Alan Devoe (Ref. 49). Discuss how man interacted with the pigeon population (both directly and indirectly). How did man affect the habitat needs of this animal? How did the white man's attitude towards this resource differ from the Indian attitude? How did white man treat other resources that were found on this continent during the same time frame (1700-1900)?
(Reference 49)

Elementary and Secondary

7. Set up a bird feeder in a place that can be easily observed from the classroom. Observe, count and record the species and number of birds that visit it daily. Continue this for the entire year. How has the

observed population changed? Correlate the bird feeder activity with the weather conditions, the availability of "natural" food, competition between and among species, and the seasonal changes.
(References 2, 6, 11, 16, 19, 20, 21, 34, 45).

Secondary

8. Animal population sizes need to be known so that the success or failure of various management schemes can be measured. A direct count is often impossible to obtain. Therefore, estimations of the population size are used. One way to demonstrate how this is done is to have your students cut up several pieces of construction paper into one-inch by one-inch squares and place all of the squares into a bag. "Capture" a small handful of squares from the bag. Mark and count the squares and "release" them back into the "population" (the rest of the squares in the bag). Mix the bag up well and "capture" another small handful. Mathematically calculate the "population" of squares in the bag by using the following formula;

$$\frac{M_t}{T_p} = \frac{M_r}{t_r}$$

where M_t = total number of "captured" and marked squares caught in the first handful.
where T_p = total estimated population.
where M_r = the number of squares that were marked during the first captured and were recaptured during the second handful.
where t_r = the total number of squares recaptured in the second handful.
(References 5, 13, 14, 20, 21, 43)

Elementary and Secondary

9. "Capture" several individual students and mark them with arm bands. Release them into your student "population" and then "capture" another group of individual students at lunch. Calculate the number of students in your class (your population) by using the formula in activity #8. Discuss the biases and unknown factors using this simplified population estimation technique.
If your students change classes have them note how the marked individuals interact with the rest of the population as they move from class to class.
(References 5, 13, 14, 20, 21, 43)

Elementary and Secondary

10. Assign each student to conduct a historic census of their neighborhood using senior citizens, businesses, newspapers, etc. Make sure that various socio-economic aspects (race, religion, ethnic background, occupation, etc.) of their "population" are included in their survey. Plot the results. Correlate the various peaks in the "population" with local, regional, and world events (a new factory opening, a mine shutting down, a war, etc.). Discuss how the various human events helped determine the make-up of the human population in the area. How are these events related to the various "limiting factors" that determine the make-up of animal populations?
(References: senior citizens, old newspapers, magazines, township records, etc.).

Elementary and Secondary

11. Conduct a cemetery investigation in the town cemetery. Consider the time span of use of the cemetery, age structure, sex ratios, occupations, religious ethnic background, and family size (reproductive success) etc. Correlate the year of death and age of death with wars, famines, diseases, severe weather conditions, etc. Relate this information to wildlife populations and changes within these populations.
NOTE: Make sure you obtain permission from the cemetery owner or manager before conducting this activity.
(Reference 50)

Elementary and Secondary

12. Make a chart of the various "limiting factors" (food, cover, water, disease, predation, weather extremes, stress, and competition). Plug in arbitrary numbers of animals in a ficticious population to illustrate how limiting factors work. (The population will equal the lowest amount). After a firm understanding of limiting factors is established adjust the numbers of correspond to short term, long term and seasonal changes in the population.
Graphically illustrate the changes that would occur over one year. The curve that has been created should represent a typical "annual turnover" curve. Can any of the organisms underneath the curve be "saved" for a longer period of time? Can these organisms underneath the curve be utilized? Compare the answers given to these questions with the definition of "conservation".
(References 5, 14, 15, 20, 22, 23, 24, 34, 45, 49)

Elementary and Secondary

13. Construct and use the Wildlife Population Simulator developed by Jerry Schierloh.
(References 48, New Jersey Outdoors Magazine (Nov-Dec 1976) Volume 3, No. 6—includes instructions for making and using. Reprints available through the Wildlife Education Unit).

Elementary and Secondary

14. Do Lesson 17 "Population Factor-Space" found on page 42. *Teachers Guide to Conservation Education* (Biology)
(Reference 23).

Elementary and Secondary

15. Play the "Rabbit Population Card Game" available (in January 1981) through the New Jersey Division of Fish, Game, and Wildlife, Wildlife Education Unit.

POPULATION DYNAMICS

Recommended Films

Conservation and Balance In Nature 18 min.—color

Investigates the dynamic balance in biological communities and man's role in changing those communities to obtain the resources he needs.

Source: International Film Bureau, 332 S. Michigan Ave., Chicago, Ill. 60604

Life in the Woodlot 17 min.—color

Emphasizes the relationship and interdependence of man, animals, and plants.

Source: State Museum, Room 25, Box 1868, Trenton, N.J. 08625

Natures Ever-Changing Communities 14 min.—color

Animation and graphics explore renewal, change and interdependence in nature.

Source: State Museum, Room 25, Box 1868, Trenton, N.J. 08625

Patterns of the Wild 28 min.—color

A fox-eyed view of the dynamics of a "natural" ecosystem.

Source: State Museum, Room 25, Box 1868, Trenton, N.J. 08625

The Wood Ducks' World 31 min.—color

One of the few "real life" stories that accurately portrays the real life of its subject. Both beautifully and accurately done.

Source: Film Department, Ducks Unlimited, Inc., Box 66300, Chicago, Ill. 60666

NOTE: This reference list is a composite list that is used for teaching all five of the concept areas. The asterisked (*) references are to be used with this curriculum guide.

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APPENDIX I
GLOSSARY OF TERMS

Animal—a living organism that is not a plant. Generally it is not able to manufacture its own food and is capable of voluntary motion.

Biosphere—that area on earth which supports life.

Biotic Diversity—a relative measure of the complexity of an ecosystem determined by the number of different *species* (plant and animal) found in a community. Often *plant diversity* and *animal diversity* are discussed separately, but are directly related.

Biotic Potential—the maximum possible growth rate of an animal population (high birth rate, low death rate).

Biotic Pyramid—Herbivore—an animal that eats only plants. Carnivore—an animal that eats only meat (other animals). Omnivore—an animal that eats plants and meat.

Carrying Capacity—the number of animals (usually used for single species) that the habitat can support.

Community—all the plants and animal populations occupying a given area.

Conservation—the wise use of natural resources.

Consumer—an organism that uses the stored energy of another organism for food. Generally prefaced by a) primary (the first) or b) secondary (the second).

Cycle—fluctuations in animal populations as related to time and number of animals.

Decomposer—an organism that participates in the nutrient recycling process of decay.

Ecology—the study of the relationships that exist between living things and their environment.

Ecosystem—the combination and interaction of both the living and non-living aspects of community. This concept can be expanded to global situations or shrunk to microscopic proportions depending upon the context in which it is used.

Ecotone—the place where two major types of communities meet and blend together.

Endangered—a species whose prospects of survival and reproduction are in immediate danger.

Extinct—a species that has no living representative.

Food Chain—the path by which energy and materials are cycled through the environment. Eating and being eaten.

Food Web—complex combination of several to many food chains.

Habitat—the kind of place where living things (plants and animals) live.

Home Range—the area in which an individual spends all or most of its time.

Limiting Factors—the things in a habitat that are needed by an animal population, but are in short supply thus limiting the carrying capacity of the habitat.

Natural Resource—anything used that is not man-made. Renewable—able to reproduce itself; living Non-renewable—unable to reproduce itself; non-living.

Niche—the function (i.e.: job or occupation) that an individual or species performs within a community.

Photosynthesis—the process by which complex organic materials are manufactured in plants using carbon dioxide and water as ingredients and sunlight as the energy source. More generally, the process by which sunlight energy is "captured" and "stored" in plants.

Plant—an organism that *is* generally capable of manufacturing its own food through photosynthesis (however there are non-photosynthesis plants, i.e.: mushrooms), and *not* capable of voluntary motion. (NOTE: in lower forms of life these characteristics do not always hold up).

Population—the total number of animals of a single kind (species) in both numbers and composition.

Population Dynamics—changes in a wildlife population over time in both numbers and composition.

Predator—an animal that survives by killing other animals for food.

Prey—an animal that is commonly killed by predators for food.

Primary Producer—an organism (plant) that changes sunlight energy into food energy that can be used by other organisms in the food-chain.

Rare—a species that is not persistently threatened with extinction but exists in such small numbers throughout its range that it may become endangered if its environment worsens.

Refuge—an area of land managed for the preservation of an animal species and/or its habitat.

Species—a class of individuals (plants or animal) having common characteristics. Usually associated with an organism that breeds "true to form."

Stress—(Shock Disease) a physiological response, within an animal, to adverse changes in the environment.

Succession—a sequence of communities which replace one another in a given area.

Territory—any defended area.

Turnover Rate—the rate at which new (young) individuals replace the old animals in a population.

Wildlife—an animal that is not dependent upon man for survival or that man does not intentionally take care of.

Wildlife Management—the science and art of changing the characteristics and interactions of habitats, wild animal populations, and men in order to achieve specific human goals by means of the wildlife resource.

NOTE:
The attached evaluation encompasses all the five topic areas within the project. If you have not received all of the topics, please fill out and return the evaluation for only those areas you have received.

SCHOOL NAME _____ GRADE _____

ADDRESS _____ AGES OF STUDENTS _____

TEACHERS NAME _____ NUMBER OF STUDENTS _____

NUMBER OF MALES _____

NUMBER OF FEMALES _____

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1. Have you attended a Teachers Wildlife Workshop sponsored by the Division of Fish, Game, and Wildlife? yes____no_____
2. If you answered yes, please indicate the place and date.
   _____
3. Is Environmental Education part of your school curriculum?
   yes____ no____ If yes, what grade level?_____
4. Please indicate the order in which the Concept units were taught.
   (1 = first, 5 = last) Leave blank if unit was not taught.

   Energy in the Ecosystem_____
   Population Dynamics_____
   Wildlife as Envir. Indi._____
   Current Wildl. Problems_____
   Man's Manipulation of Ecosystems_____
5. In the future, would you teach the concepts units in the same order as above? yes____ no_____
6. If not, please indicate the order in which you would most likely follow in the future.

   Energy in the Ecosystem_____
   Population, Dynamics_____
   Wildlife as Envir. Indi._____
   Current Wildl. Problems_____
   Man's Manipulation of Ecosystems_____
7. Please indicate the amount of time spent on each concept and include field trips, etc.

   Energy in the Ecosystem_____
   Population Dynamics_____
   Wildlife as Envir. Indi._____
   Current Wildl. Problems_____
   Man's Manipulation of Ecosystems_____
8. In which subject areas were the concepts integrated?

	yes	no
Science	_____	_____
Math	_____	_____
Social Studies	_____	_____
Art	_____	_____
English	_____	_____
Other_____	_____	_____

9. Do you feel that using wildlife as a medium for teaching environmental education helped stimulate your students interest?
   yes_____ no_____
10. Did any guest speakers talk to your class as part of this program?
    yes_____ no_____
11. If you answered yes to the above question, please list below the speaker's name, affiliation and the topic of which he/she spoke.
12. Would you recommend this manual to other teachers for their use?
    yes_____ no_____
13. If you answered no to the above question, please state your reasons on the back of this page.
14. This manual discussed five environmental concepts. If there are other concepts that you would like to see included in this manual, please list them below.

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15. Consider the entire environmental education manual How would you rate the following aspects of the manual?

	adequate	inadequate (needs improvement)
discussion of ideas	_____	_____
explanation of terminology	_____	_____
wildlife examples	_____	_____
suggested readings and references	_____	_____
experiments	_____	_____
classroom activities and exercises	_____	_____
outdoor activities and exercises	_____	_____
suggested films and slides	_____	_____

16. If you indicated that any of the above areas need improvement, please explain your reasons as well as any suggestions that will help us in the space below.

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Mail to:

Wildlife Education Unit
Division of Fish, Game & Wildlife
State Fish Hatchery
Hackettstown, N.J. 07860

The following section deals with each concept unit and the main ideas presented as part of that unit. The first column asks for an evaluation of the idea by the teacher. The second and third column asks for a judgement on your classes knowledge of the idea before and after this concept was taught. Please circle the appropriate response. Additional comments to help us improve this manual are welcomed.

STATEMENT	EVALUATION					PRIOR KNOWLEDGE				PRESENT KNOWLEDGE			
a = adequate i = inadequate	discussion	films/slides	classroom activities	outdoor activities	readings & references	excellent	good	fair	poor	excellent	good	fair	poor
ENERGY IN THE ECOSYSTEM													
the sun is the primary energy source for all life on earth	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
all food & energy is derived from ecosystems	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
life-death-birth is an energy transfer process upon which all organisms depend (including man)	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
POPULATION DYNAMICS													
animal populations fluctuate in response to environmental influences (dynamic balance)	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
animal populations are regulated by limiting factors	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
wildlife is a renewable natural resource	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
WILDLIFE AS AN INDICATOR OF ENVIRONMENTAL QUALITY													
the term "wildlife" includes all undomesticated animals both vertebrates & invertebrates	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
animals exist in habitats which provide their living requirements	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
man can use certain animals as indicators of environmental quality	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
man too has living requirements which must be fulfilled in order to survive in a particular area	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
CURRENT WILDLIFE PROBLEMS													
wildlife like other renewable resources can be harvested indefinitely if managed properly	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
habitats can be managed to increase their ability to support wildlife	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
wildlife species become endangered for several reasons— the most common of which is destruction of suitable habitat	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
wide scale use of pesticides has adversely affected many wildlife species	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
the "American standard of living" can both hinder & help the plight of endangered species	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
MAN'S MANIPULATION OF ECOSYSTEMS													
animals exist in habitats which provide their living requirements	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
man changes ecosystems to provide for his own living requirements	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
when man changes ecosystems he also changes the wildlife populations that are associated with those ecosystems	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p
	a i	a i	a i	a i	a i	e	g	f	p	e	g	f	p

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